

CLAIMS

WHAT IS CLAIMED:

1. A method, comprising:

processing a plurality of workpieces to form at least one feature on each workpiece;

5 measuring a plurality of characteristics of the feature;

constructing a covariance matrix including diagonal and non-diagonal terms for the

plurality of characteristics measured;

monitoring at least the non-diagonal terms of the covariance matrix; and

determining a sampling plan for measuring the workpieces based on the monitoring.

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2. The method of claim 1, wherein monitoring the non-diagonal terms of the covariance matrix further comprises determining that at least one of the non-diagonal terms has crossed a predetermined threshold.

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3. The method of claim 1, wherein monitoring the non-diagonal terms of the covariance matrix further comprises identifying a trend in at least one of the non-diagonal terms.

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4. The method of claim 1, wherein monitoring the non-diagonal terms of the covariance matrix further comprises:

receiving measurements of the characteristics of the feature on a current workpiece;

identifying relationships between the measurements of the characteristics for the current workpiece;

comparing the identified relationships to relationships present in the covariance matrix as defined by the non-diagonal terms; and

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identifying a mismatch between the relationships for the measurements of the characteristics for the current workpiece and the relationships present in the covariance matrix.

5 5. The method of claim 1, wherein monitoring the non-diagonal terms of the covariance matrix further comprises calculating at least one singular value for the covariance matrix, and determining the sampling plan further comprises determining a sampling frequency of the sampling plan as a function of the singular value.

10 6. The method of claim 6, wherein determining the sampling plan further comprises determining the sampling frequency as a multiple of the singular value.

 7. The method of claim 1, wherein determining the sampling plan further comprises determining a sampling plan for subsequently processed workpieces.

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 8. The method of claim 1, wherein monitoring the non-diagonal terms of the covariance matrix further comprises identifying a disturbance in the covariance matrix, and determining the sampling plan further comprises associating a particular workpiece with a deviation in the covariance matrix and determining a sampling plan for the particular
20 workpiece.

 9. The method of claim 1, wherein determining the sampling plan further comprises determining a sampling frequency based on the monitoring.

10. The method of claim 1, wherein determining the sampling plan further comprises selecting a particular workpiece for subsequent metrology collection based on the monitoring.

5 11. A system, comprising:
a plurality of tools configured to process a plurality of workpieces to form at least one feature on each workpiece;
at least one metrology tool configured to measure a plurality of characteristics of the feature;
10 a sampling controller configured to construct a covariance matrix including diagonal and non-diagonal terms for the plurality of characteristics measured, monitor at least the non-diagonal terms of the covariance matrix, and determine a sampling plan for measuring the workpieces based on the monitoring.

15 12. The system of claim 11, wherein the sampling controller is further configured to monitor the non-diagonal terms of the covariance matrix by determining that at least one of the non-diagonal terms has crossed a predetermined threshold.

20 13. The system of claim 11, wherein the sampling controller is further configured to monitor the non-diagonal terms of the covariance matrix by identifying a trend in at least one of the non-diagonal terms.

25 14. The system of claim 11, wherein the sampling controller is further configured to monitor the non-diagonal terms of the covariance matrix by receiving measurements of the characteristics of the feature on a current workpiece, identifying relationships between the

measurements of the characteristics for the current workpiece, comparing the identified relationships to relationships present in the covariance matrix as defined by the non-diagonal terms, and identifying a mismatch between the relationships for the measurements of the characteristics for the current workpiece and the relationships present in the covariance
5 matrix.

15. The system of claim 11, wherein the sampling controller is further configured to calculate at least one singular value for the covariance matrix and determine a sampling frequency of the sampling plan as a function of the singular value.

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16. The system of claim 16, wherein the sampling controller is further configured to determine the sampling frequency as a multiple of the singular value.

17. The system of claim 11, wherein the sampling controller is further configured
15 to determine a sampling plan for subsequently processed workpieces.

18. The system of claim 11, wherein the sampling controller is further configured to identify a disturbance in the covariance matrix, associate a particular workpiece with a deviation in the covariance matrix, and determine a sampling plan for the particular
20 workpiece.

19. The system of claim 11, wherein the sampling controller is further configured to determine a sampling frequency based on the monitoring.

20. The system of claim 11, wherein the sampling controller is further configured to select a particular workpiece for subsequent metrology collection.

21. A system, comprising:

5 means for processing a plurality of workpieces to form at least one feature on each workpiece;

means for measuring a plurality of characteristics of the feature;

means for constructing a covariance matrix including diagonal and non-diagonal terms for the plurality of characteristics measured;

10 means for monitoring at least the non-diagonal terms of the covariance matrix; and

means for determining a sampling plan for measuring the workpieces based on the monitoring.

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